THE MODEL ENGINEER

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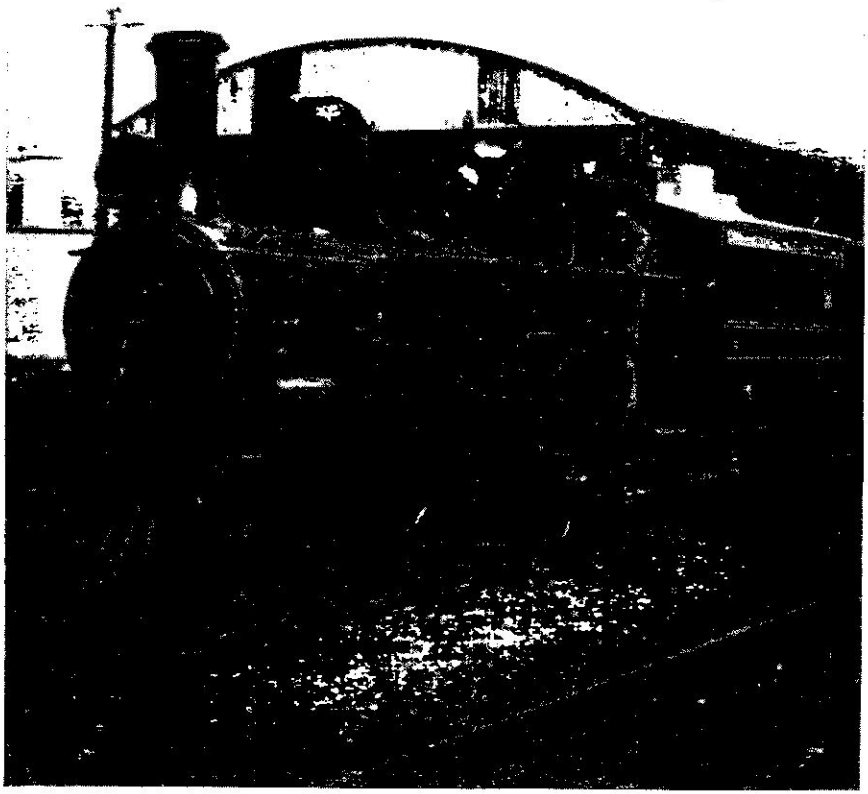

The 4-4-0 Tank locomotive, No. 4 (S), Great Southern Railways (Ireland), Schull and Skibbereen branch, 3-ft. gauge. Photograph taken in 1938 by Mr. John Denley

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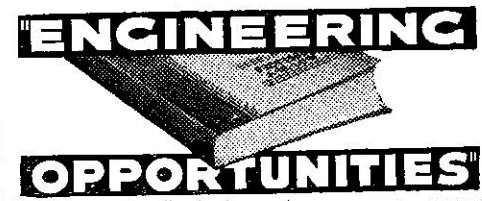

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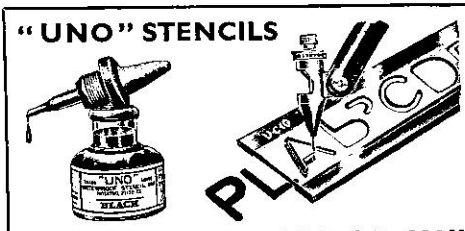

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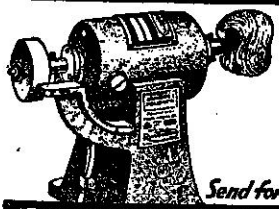

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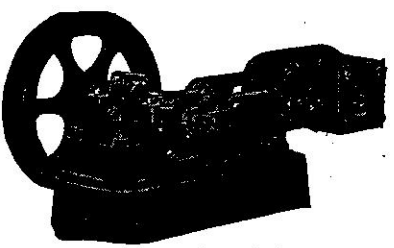

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THE MODEL ENGINEER

Vol. 94 No. 2337 Percival Marshall & Co., Limited Cordwallis Works, Maidenhead February 21st, 1946

Smoke Rings

This Week's Cover Picture

SOME of the builders of miniature locomotives favour the selection of narrow-gauge prototypes, usually because of the scope there is for producing larger engines in relation to the track-gauge. Very often this practice is applied to the reproduction of such immense locomotives as are common on, say, the South African railways; the result is, of course, the production of comparatively huge engines on the 2½-in., 3½-in., or 5-in. gauges that are so popular at present. But not all narrow-gauge prototypes are of ultra-massive proportions, and the subject of our cover-picture is a case in point. Although the track-gauge is only 3 ft., the 4-4-0 tank engine seen is not so large as most engines of the same type built for the standard 4-ft. 8½-in. gauge. She was built in 1888, by Nasmyth, Wilson and Company, and is interesting because she was the first engine in Ireland to have a Belpaire firebox. Formerly, she was named *Erin*. Her cylinders are 12 in. by 18 in.; coupled wheels, 3 ft. 4 in. diameter; bogie wheels, 1 ft. 10 in. diameter; wheelbase, 15 ft. 3 in., and weight in working order, 24 tons.

The "M.E." Exhibition

OUR 1946 exhibition, which marks the 21st anniversary of the founding of this Mecca of the model engineering world, will be a memorable occasion, for it will incorporate a new element of managerial control and direction. Up till the present year the show has always been the sole responsibility of THE MODEL ENGINEER, and our staff have undertaken the entire burden of organisation and supervision, no light addition to our normal editorial and publishing duties. We have seen the exhibition grow from a very modest beginning into an affair of nation-wide interest and influence. It has been organised with a desire to raise the standard of model engineering effort and to increase the public understanding of the objects and achievements of model engineers, rather than with any actual profit making in view. The remarkable popularity of the exhibition has fully justified all the thought and energy which have been bestowed upon it during the twenty years of its existence as an annual function. But let me give credit where credit is due. No amount of organising effort would have made this success possible without the willing co-operation of many of the Clubs and Societies which have grown up in the model making field, and the interesting contributions which have been made by the individual participants in our competition and loan sections. The practical support of the leading tool and model supply firms has been another valuable element in the general attraction and utility of the show. From the Club side I would like to pay an especial tribute to the Society of Model and Experimental Engineers, whose passenger-carrying track and collection of members' models have always been an outstanding feature of the show. This Society has, in recent years, extended the benefits of affiliation to a number of the active clubs within the London area, a step which has raised its virtual membership to close upon the thousand mark. So strong a representation of model engineering interests seemed to me worthy of more than an unofficial share in the staging of the show, and as the result of a friendly conference with the Society's Council, it has been agreed that the organisation of the 1946 exhibition should be a joint affair. At the same time, the growing importance of model aviation has indicated the desirability of this section of the model world being more adequately represented in the show than in pre-war years. A similar approach to the Society of Model Aeronautical Engineers, the parent technical body, resulted in a very willing agreement to co-operate in sponsoring a really representative model aircraft section. The organising of the show will, therefore, be carried out jointly by ourselves and the two Societies referred to. It will be what in political circles used to be known as a triple alliance, or in more modern parlance, a tri-partite pact. The precise responsibilities of the partners for the acceptance and staging of the exhibits will be announced in due course, so that those interested may know to whom and where to apply for information, but there is no doubt that with the increased space available in the New Horticultural Hall, and the wider personal interest in planning and supervising the details, the 1946 exhibition will be a super-show of all branches of the model makers' art. The usual competitions for the Championship Cups, will, of course, be held, and several friends of THE MODEL ENGINEER have already offered some generous additions to the prize list. To remind you, the date will be August 22nd to the 31st, both days inclusive, but not Sunday.

Percival Marshall

*A Model Engineer Among the Watches

By C.S.C.E.

A CONTEMPORARY of Halsted, Thomas Tompion, was the most celebrated of all the great English watch and clockmakers. Fig. 5 shows a plain verge movement of his make, *circa* 1680. The fusee chain can be seen on the barrel to the right, the contrate wheel which drives the escape pinion, to the left, and the large thin balance shows edge-on between the top plate and balance cock. The pillars, the design of which is quite a feature of that date, are pierced with a slit which runs off to a complete knife edge at the bottom. They are so nicely made that it is not easy to detect how the slit is tapered off to nothing in this manner, but close examination suggests that it is first cut to the full width, and subsequently squeezed in at the bottom end, and then the bottom flange and fillet was filed up square afterwards.

Fig. 6 is an English pocket chronometer movement by Daniel Lamport, London. Apart

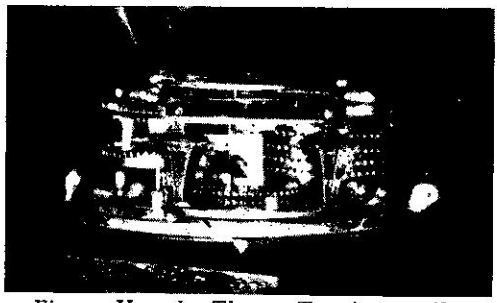


Fig. 5. Verge by Thomas Tompion, c. 1680

from the unsuitability of the chronometer escapement for pocket watches, the fact that this escapement was always fitted with a helical, instead of a flat spiral, balance spring, caused these watches to be excessively thick. Thus, no case could be found anywhere deep enough to house it, and it now reposes, as seen, in a pocket voltmeter case. At one period pocket chronometers enjoyed a considerable vogue, but the nature of the escapement, though unexcelled for accurate timekeeping, is such that it is very liable to be stopped and subsequently sometimes restarted, by jolting in the pocket, and so passed quite out of favour.

The "pin-pallet" type of lever escapement is often regarded as having been exclusively employed in mass-produced watches, etc., of the cheapest type. Fig. 7 is of interest, as it shows a good quality jewelled movement, with Breguet balance spring and compensated balance, by Gutkies and Lange, *circa* 1840, which uses this type of escapement. The accessibility is a very unusual feature.

The mechanism of the verge, cylinder, and lever escapements are fully described in the MODEL ENGINEER Handbook, and being the types most frequently met with, it is not considered necessary to do so again in this article. Fig. 8 shows an English lever watch the writer has converted to a modified "lobster claw" escapement. This was invented by the celebrated watchmaker, A. Tavan, in 1796, but although he made a large working model of the escapement, it seems unlikely that any watch was made employing it, as shortly after, he brought out a more complicated and perfect one, developed from it, which he incorporated in a watch of extreme accuracy. In the photograph, the balance is displaced and inverted to show the impulse arm. This escapement, detailed in Fig. 9, is really a combination of the lever and chronometer escapements, utilising the direct (single acting) impulse to the balance from the escape wheel teeth of the latter, and employing the lever only for controlling the locking and release of the escape wheel. It will be seen that the ordinary lever with pallets engaging radial teeth of a normal escape wheel, is replaced by the lever L, pivoted further back than usual at S. It contains a square "window" through which can be seen the receiving and discharge pallets, R.P. and D.P. respectively. These perform the locking function only, have nothing to do with providing the impulse like the pallets in the ordinary lever, and are attached to the underside of the lever L by the two 16 B.A. screws. The roller R and fork action are normal, and steam engine enthusiasts will see that it is

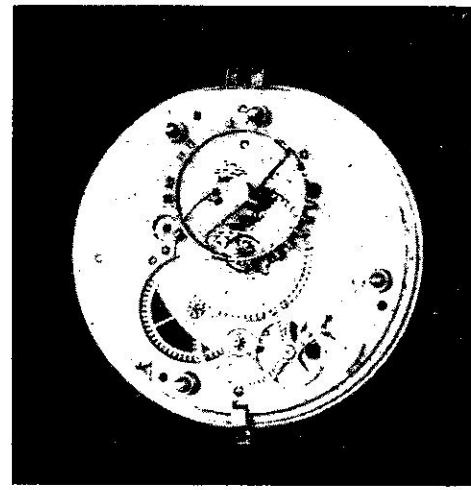


Fig. 8. Modified "Lobster-Claw" escapement. Inventor, A. Tavan, 1796

*Continued from page 144, "M.E." February 7, 1946.

Fig. 6. English pocket chronometer, by Daniel Lamport

analagous to the " Scotch crank." The original escape wheel of 15 radial teeth is replaced by a new one, E, having 10 vertical rectangular teeth, as T T, and 1, 2 and 3, shown black, of which No. 1 is shown locked on the discharge pallet D.P., and No. 3 about to engage the impulse arm I, which is an addition to the balance staff. The balance B, is omitted from the plan view for clarity. The action, commencing from the position of the parts in Fig. 9, is as follows :—

On rotating the balance, B, slightly anti-clockwise, L will move slightly clockwise, pivoting on its staff at S. Tooth 1 will then drop off D.P., and E, impelled by the mainspring via the train, will rotate rapidly clockwise, tooth 3 giving a sharp impulse to the balance via the impulse arm I. By the time the circular paths of I and tooth 3 are clear of each other, L has moved clockwise a further small amount, sufficient to interpose the tip of R.P. in the path of the teeth, and tooth 2 is arrested thereon. The balance, with I, continues its anti-clockwise journey, until its momentum is exhausted by the coiling up of the balance spring B.S. On the return journey, clockwise, L is, of course, moved anti-clockwise, and tooth 2 is transferred from R.P. to D.P., ready for the next cycle of operations.

Needless to say, a number of difficulties were encountered in this conversion job. It was almost essential to retain the existing centres and disposition (planting) of the balance staff and escape wheel arbor. The pallet staff S of the original lever was planted about 1/64 in. above the present position of tooth 1, and had to be re-planted considerably to the right as shown. The bottom bearing bracket for balance staff, or pottance, as it is termed, had to be set up on a shellac chuck and machined back from the dotted line to the new position, to give clearance to the long impulse arm I, to swing round. The mainspring barrel, for the same reason, had to be re-planted about 1/64 in. from its original position. The lever outline was marked off on an old steel winding wheel, and sawn and filed to size. The square hole in the centre of the wheel, slightly enlarged, forms the window. The two pallets are tapped 16 B.A. and clearance holes are drilled through the wings of the lever.

The escape wheel is made of hard brass rod as follows :—

A piece of ½-in. round brass was chucked in the lathe, faced back leaving a boss as at E, and

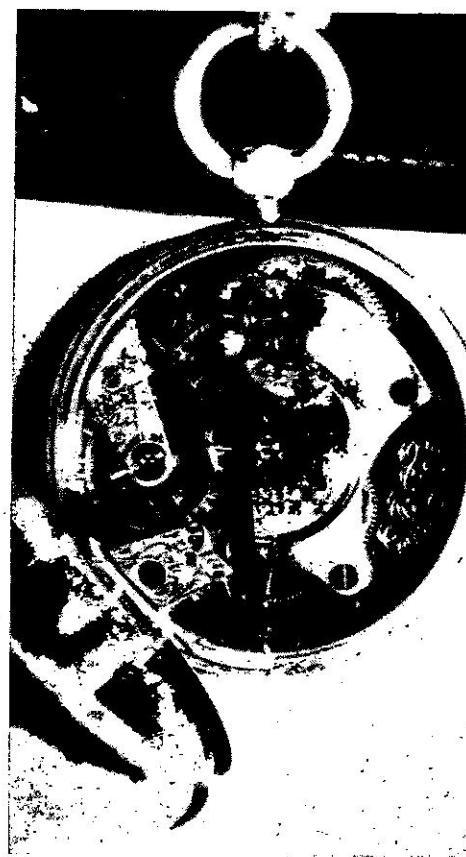


Fig. 7. Jewelled Pin-pallet lever, by Gutkies and Lange, c. 1840

parted off full width of finished wheel. The bar was then faced again, centre-drilled clearance for E, and the blank sweated thereto, with E in the recess. It was then recessed, leaving an annular rim .020 in. high by .015 in. radial width. Using a division plate on the mandrel, and a square ended dental burr in a high speed milling spindle on slide-rest, the surplus rim was milled away, leaving 10 teeth, .010 in. circular width. Five large holes were drilled in the spaces between the arms, or crossings, as they are termed, and were subsequently filed out to contour. The centre hole for the escape arbor could have been centred and drilled before unsoldering the wheel, but in the writer's case was transferred, after unsoldering and cleaning off, to a step chuck in a watchmaker's lathe to do this operation. It is, of course, drilled undersize, and broached to fit tightly on the staff.

The geometry of the escapement, circumscribed as it is by the desirability of retaining existing centres of spindles, made it impossible to employ more than 10 teeth, as against the original 15. This made a further difficulty, as, in order to keep time, the vibrations of the balance had to be slowed down in the ratio of 15 to 10. This was eventually accomplished, after much fiddling work, by using both a weaker balance spring and heavier screws in the balance rim. Each time an alteration was made, the balance assembly had to be removed, and although this is a fairly quick operation with the normal type, it means a good deal of juggling in this case to clear arm I, as well as the roller, particularly when reinserting. Any watchmaker will see at a glance at Fig. 8, that no attempt has been made to adjust the compensation, the writer being thankful when he had arrived at an arrangement of assorted screws which gave the balance the desired moment of inertia, and at the same time left it in static balance, or "poised" as it is called.

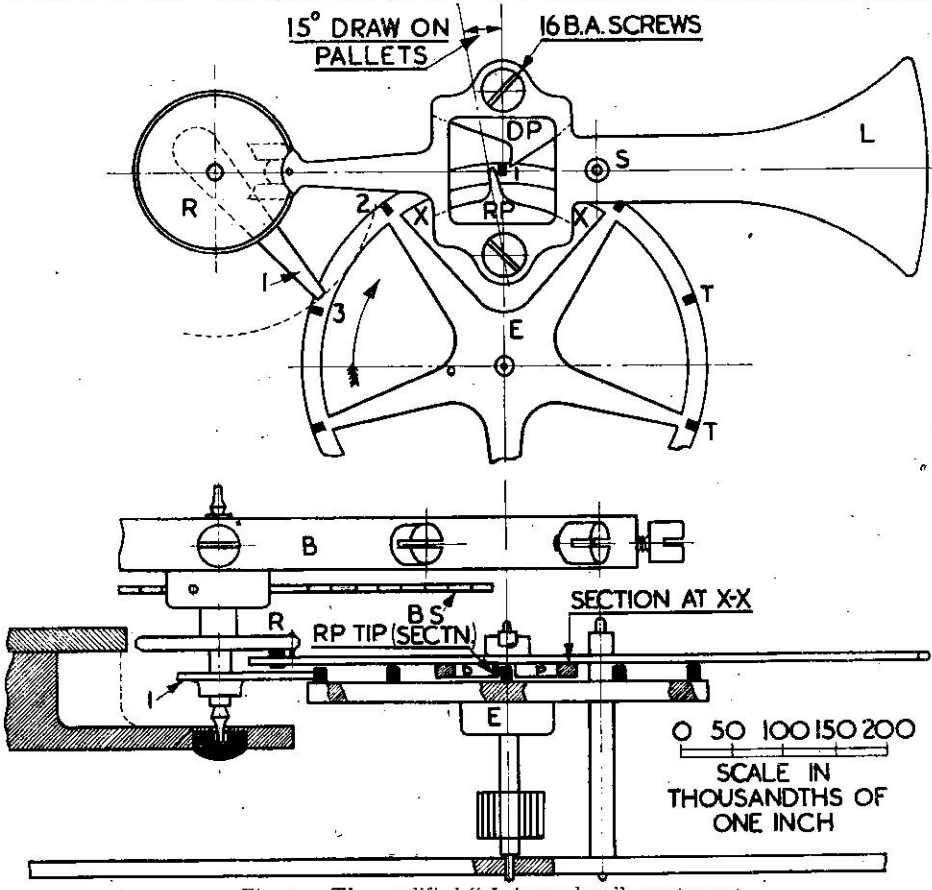


Fig. 9. The modified "Lobster-claw" escapement

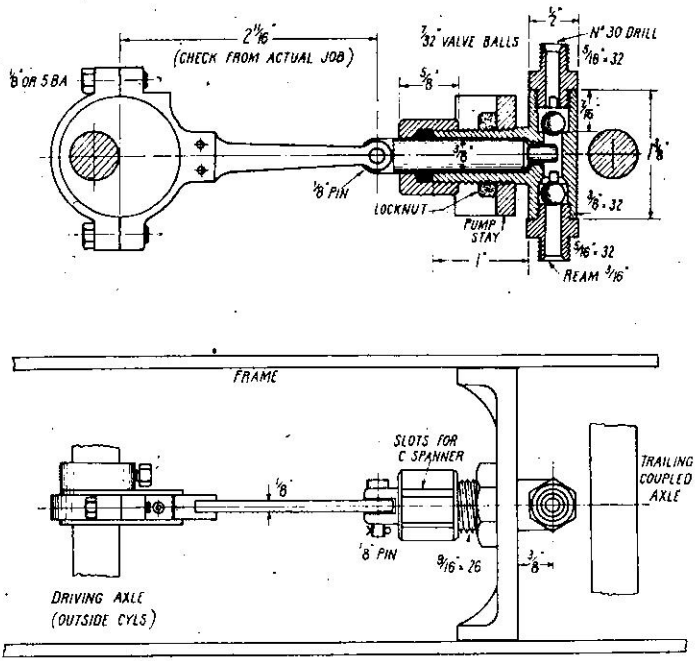
In conclusion, it is suggested that watchwork can offer much of interest to the model-maker who is accustomed to the smaller types of work. The job of repairing some of the more complicated mechanisms when they are deranged, is of absorbing interest. The mechanism of a minute repeater, for example (repeats the previous hour, and also all quarters and minutes that have elapsed up to time, on depressing a lever) just has to be seen in action before it is possible to believe it is true.

"Hielan' Lassie"

By "L.B.S.C."

A 3½-in. Gauge L.N.E.R. 4-6-2

BEFORE erecting the wheels and axleboxes, we might as well make and fit the boiler feed-pump, which will save taking them off again for that specific purpose. Two alternative sizes and types are given for the pump, for the following reasons ; you can use whichever you fancy. When a locomotive runs on a short up-and-down line, with continual starts and stops, it naturally uses a lot more water than one running well notched up on a continuous track ; and if the pump is the only means of filling the boiler, it must be made big enough to keep up the supply under all conditions of working. Before my own 250-ft. nonstop road was opened, in November, 1936, I only had 52 ft. of straight line, and at that time "Ayesha" was fitted with a pump $\frac{5}{16}$-in. bore and $\frac{3}{8}$-in. stroke, and had no injector. This pump satisfied the conditions. I used to run with the by-pass entirely closed until the water reached the top road was opened, the pump promptly commenced to flood the boiler, the by-pass cock having to be very nearly full open to keep the gauge glass showing correct level, the pipe friction—the by-pass pipe is $\frac{1}{8}$-in. diameter—apparently taking nearly as much power to overcome it as was needed for the feedwater to "bump" the clacks and enter the boiler. I didn't see the sense in wasting a lot of power for no return, although power is the one thing that is never "in short supply" on any of my locomotives !—so I took off the $\frac{5}{16}$-in. bore pump and replaced it by one having a ram less than $\frac{1}{4}$ in. diameter ; 6 mm. to be exact. This little gadget took far less power to drive, and supplies all the water needed. Although it is seldom used now for service, as I do all my injector testing on the old girl, and she has one of her own as well, for use when there is no testing to be done, the by-pass can be set to maintain practically constant



Pump for continuous running

nut, and then opened the by-pass fully until the level dropped to about one-third of the glass. The by-pass valve was a plain plug cock, and it took some delicate adjustment to find a place where the water would be by-passed just enough to keep the water in the boiler approximately level ; so I rarely bothered about fine adjustments, and operated as above. When the new level. With a single passenger, the by-pass cock is closed until the stream from the pipe, which is visible under the filler opening, is just reduced to a rapid succession of drops. With two passengers the cock is closed entirely.

"Sybil," the 2½-in. gauge L.N.W.R. 4-4-0 which has the smallest boiler of any of my 2½-in. gauge engines, has a pump only $\frac{3}{16}$-in.

bore. I described the experiment with this tiny boiler-feeder, and how it proved quite a success; the boiler is never short of water. "Annabel," the 2-6-6-4 Mallet, has the biggest boiler of the lot; in fact, it is bigger than the one I shall specify for "Lassie." When it was first built, it had two twin pumps, one on each engine (she is really two engines under one boiler) so there were four barrels in all, with rams $\frac{5}{16}$-in. bore and $\frac{3}{8}$-in. stroke. When I overhauled the engine for the late "Bro. Wholesale," I found all four were useless. The twin on the front engine was scrapped, and the space and driving gear used for a mechanical lubricator; the other twin was put in order, and is still on the engine. On my non-stop, with four passengers up, this component will fill the boiler right up to the safety-valves, if the by-pass valve is left closed, whilst the boiler is supplying four $\frac{7}{8}$-in. by $1\frac{1}{2}$-in. cylinders and running at a good speed. Judging by the results given above, I should estimate that a single pump $\frac{3}{8}$-in. bore and $\frac{1}{2}$-in. stroke would do the needful for "Lassie's" boiler on a non-stop run with normal load, provided the cylinders and motion are not wasting steam, and the driver knows his job. For a start-and-stop performance, it would be advisable to use a pump $\frac{1}{2}$-in. bore, if no injector is fitted; so I am giving both sizes in an endeavour to please all builders. My own honest advice is to fit the smaller pump, and if you find at any time the boiler needs more water, put a drop in with the injector. Personally, I should use an injector for service, fitting two of them, same as a big engine, and not bothering about fitting pumps at all. Saves a dickens of a lot of plumbing! Still, different folk have different fancies; so, to business.

Smaller type—Barrel and Valve-Box

The barrel and valve-box are cast in one piece; castings are available, the same type being used as on "Bantam Cock." Chuck in three-jaw, holding by one end of the valve-box, and set the other end to run truly. Face, centre, and drill right through with 11/64-in. or No. 16 drill. Open out to about $\frac{5}{16}$ in. depth with letter "R" or 11/32-in. drill, and bottom to $\frac{7}{16}$ in. depth with a D-bit. Slightly countersink the end; tap $\frac{3}{8}$ in. by 32, taking care not to let the tap spoil the D-bitted seat, then skim off any burr. Chuck any odd bit of brass rod, $\frac{1}{2}$ in. diameter or over, in the three-jaw, and turn down $\frac{3}{16}$ in. of it to $\frac{3}{8}$ in. diameter, screwing it $\frac{3}{8}$ in. by 32 with a die in the tailstock holder, and truing up the shoulder with a knife tool if needed. Don't remove it from the chuck, but screw the tapped end of the valve-box on to it; the outer end should now run quite truly. Serve it exactly the same as you served the other end, except that the D-bit need not be used; instead, make four little nicks around the edge of the small hole, with a little chisel made from a bit of $\frac{1}{4}$-in. silver-steel.

Next, chuck the casting by the chucking-tenon which you will find on the back of the valve-box, opposite to the barrel, and set the latter to run truly. Face the end, centre, and drill down with a $\frac{9}{16}$-in. drill until it breaks into the hole through the middle of the valve-box. Open out to a depth of 1 in. with a $\frac{5}{8}$-in. drill. Turn down $\frac{7}{8}$ in. of the outside to $\frac{9}{16}$ in. diameter, and screw $\frac{9}{16}$ in. by 26. Skim any burring off the end, and finally put a $\frac{3}{16}$-in. reamer through the remains of the small hole in the middle of the valve-box, to true it for the ball seat, and remove any burr from the barrel drilling. The chucking-piece can be sawn off, and the stub filed flush with the valve-box.

Valves and Caps

Drop a 7/32-in. rustless steel ball in the D-bitted end of the valve-box, and seat it by holding a bit of $\frac{3}{16}$-in. brass-rod on the ball and giving the end of the rod one sharp crack with a hammer. Rest the other end of the valve-box on a block of lead. Beginners note that too much walloping will distort the seating. Take the depth from top of ball to top of valve-box with a depth gauge; a home-made one can be made in a few minutes by drilling a No. 41 hole through the middle of an inch of $\frac{1}{4}$-in. square brass rod, fitting a 3-in. length of 3/32-in. silver-steel in it, and drilling and tapping the side for a set-screw, so that the piece of steel can be held at any part of its length. Chuck a piece of $\frac{7}{16}$-in. hexagon brass rod in the three-jaw, face the end, and turn it down to $\frac{3}{8}$ in. diameter for a length of 1/32 in. less than indicated by the depth gauge; screw $\frac{3}{8}$ in. by 32, and part off at $\frac{1}{2}$ in. from the shoulder. Re-chuck the other way around, in a tapped bush. Chuck a short bit of $\frac{1}{2}$-in. rod in three-jaw; face, centre, and drill through with letter "R" or 11/32-in. drill; slightly countersink the end, tap $\frac{3}{8}$ in. by 32 and skim off any burr. Screw the embryo valve-cap into this, turn down $\frac{5}{16}$ in. length to $\frac{5}{16}$ in. diameter, and screw $\frac{5}{16}$ in. by 32; centre deeply with a size "E" centre-drill, and drill right through with No. 30. Cross-nick the shorter end with a thin flat file, such as used by key cutters or clockmakers. Both sides of the hexagon can be slightly chamfered for appearance sake, and the cap screwed home with a smear of plumbers' jointing around the shoulder; but be mighty careful that none gets inside the ball chamber, or the ball will promptly stick to the seating, and cattle up the feed altogether.

Turn the pump upside down, and drop another ball into the other end of the valve-box; take depth as before, but this time, turn the $\frac{7}{16}$-in. rod to the same length as indicated by the depth gauge. Screw it $\frac{5}{16}$ in. by 32, with the die in the tailstock holder, and part off at $\frac{1}{2}$ in. from the shoulder. Re-chuck in the tapped bush, and repeat operations described above, except that an 11/64-in. or No. 16 drill is used in place of the No. 30. Reverse the piece in the tapped bush; put a $\frac{3}{16}$-in. parallel reamer through, then skim just 1/32 in. off the end, to true it up and bring the piece to right length. Seat the ball on the end of the reamed hole, as described above, and screw home.

Ram and Gland

The ram, or plunger, is made from a piece of $\frac{3}{8}$-in. ground rustless steel or drawn phosphor-bronze, approximately $2\frac{1}{8}$ in. long. Chuck truly in three-jaw; if the chuck is "out," put a bit of paper or foil between the offending jaw

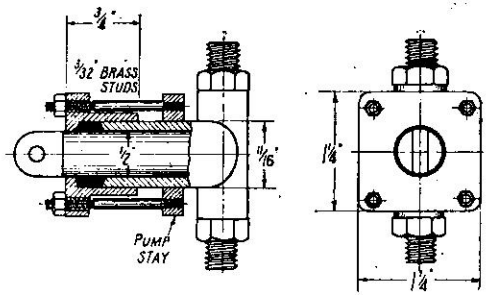
and the rod. Turn down $\frac{5}{16}$ in. length to 11/64 in. diameter, so that the projection which I call the anti-airlock pin, will enter the $\frac{3}{16}$-in. hole in the end of the pump-barrel quite easily. Bevel-off the shoulder to the same angle as the point of the drill used for the pump barrel, and slightly round-off the end of the pin. Reverse in chuck, face the other end and then slightly round-off the sharp edge, or bevel it. A slot $\frac{1}{8}$ in. wide and $\frac{3}{8}$ in. deep is required in the end, for the eye of the eccentric rod, and if a $\frac{1}{8}$-in. slotting-cutter is available, mount it on an arbor (old bolt will do) gripping same in chuck. Clamp the pump-ram under the slide-rest tool-holder and run it up to the cutter; slow speed and feed, plus plenty of cutting-oil, will do the doings in fine style. Cross-drill No. 31 for the pin, and ream $\frac{1}{8}$ in.; put a piece of $\frac{1}{8}$-in. flat stuff in the slot whilst drilling. You'll soon find out why this is desirable, if you don't! Run the drill through the lot.

For the gland, chuck a piece of $\frac{3}{4}$-in. round bronze, $\frac{5}{8}$ in. long, or the casting if provided; face the end, centre, drill right through with $\frac{1}{4}$-in. pilot drill and open up to $\frac{7}{16}$ in. depth with $\frac{1}{2}$-in. drill. Tap $\frac{9}{16}$ in. by 26, chamfer the end, then reverse and chamfer the other end, facing off if necessary. Four C-spanner slots are needed; if you have a planer, shaper or milling machine, this is only a few minutes' work and needs no description. If not, start with a hacksaw and finish with a file. The slotting-saws supplied with the "Eclipse" 4S tool do this job very well.

Screw the pump barrel through the tapped hole in the stay, and secure it with a locknut $\frac{3}{16}$ in. in thickness, made from $\frac{1}{4}$-in. hexagon rod; or a casting may be supplied for it. Simply chuck truly in three-jaw, face, centre, and drill and tap same as gland. Reverse, face off, and chamfer. Be sure you get the pump right way up, with the D-bitted end of the valve-box on top. Insert the ram, and pack the gland with a few strands of graphited yarn, or hydraulic pump packing, which is braided up like rope and has to be unravelled for use in small pumps. It is fine stuff, doesn't leak if properly applied, and ensures minimum of both friction and wear, on the pump-ram. The pump stay can then be erected in the frames, as shown both in the accompanying illustrations, and the plan of frames in a previous instalment. The back of the stay should clear the rear coupled axle by $\frac{1}{4}$ in.; and the centre-line of the pump barrel should be level with centre of driving-axle in running position, that is, $\frac{3}{4}$ in. from bottom edge of frame. The stay is fixed by three $\frac{1}{8}$-in. or 5-B.A. countersunk screws running through the already drilled holes in frame, into tapped holes in the flanges of the stay.

Eccentric-Strap and Rod

Clean up the casting with a file; centre-pop the lugs and drill them No. 40. Saw across, using a thin-bladed saw, and the vice-jaws for guide; and don't forget to put a couple of centre-pops on the two lugs on one side, so they can be replaced the correct way after parting. Rub the sawn faces on a flat file laid on the bench, to remove saw-marks; then open out the holes in the ring section with No. 30 drill, tap the corresponding holes $\frac{1}{8}$-in. or 5-B.A. and screw temporarily together. Chuck in four-jaw with the centre hole (now a bit oval) running as truly as possible; face the side, and bore out to an easy running fit on the eccentric. The best way to get the right size is to use as a gauge, a bit of round rod turned to same diameter as the groove in the eccentric, using an ordinary boring tool for the job. You can use the gauge as a mandrel for facing the other side; chuck it in three-jaw, and clamp the strap on it by its own screws, putting a bit of paper between strap and mandrel, to prevent any slipping. A $\frac{1}{8}$-in. slot is cut in the back lug by planing or milling; or if you have no means of machining, careful sawing or filing will do it. However, as I described when dealing with milling jobs on "Petrolea," the lathe is a good substitute for a miller, if you bolt a machine-vice to the saddle, and use a cutter mounted on an arbor run between centres and driven by a carrier and catch-plate, or driver chuck. In the present instance, the eccentric strap could be set in the machine vice at a height suitable for cutting out the slot to full depth at one fell swoop, and traversed under the cutter by means of the cross-slide. Curly used to perform all sorts of conjuring tricks with a lathe in the days when that machine had to serve as a universal tool, and was pressed into service for everything that came along.



Alternative type of pump

The eccentric-rod is filed or milled to shape from a bit of $\frac{1}{8}$-in. flat steel, to the shape shown in the drawing, and should be a tight fit in the slot, in which it is secured by a couple of rivets. You can solder it as well if you like, before putting the rivets in. Leave it a good length, and get the exact position of the hole in the eye as follows. Put the axle temporarily in place with the eccentric on it. Push the ram right back into the pump-barrel as far as it will go. Put the eccentric on back dead centre, the position shown in the illustration, and enter the end of the rod in the slot in the ram. With a bent scriber, mark the outline of the cross-hole in the ram, on the rod. Remove strap and rod, make a centre-pop on the rod 1/32 in. nearer the strap, than the position indicated by the circle; drill No. 31 and ream $\frac{1}{8}$ in. Round off the end of the rod, to suit the hole. Case-harden by heating to red and dipping in any

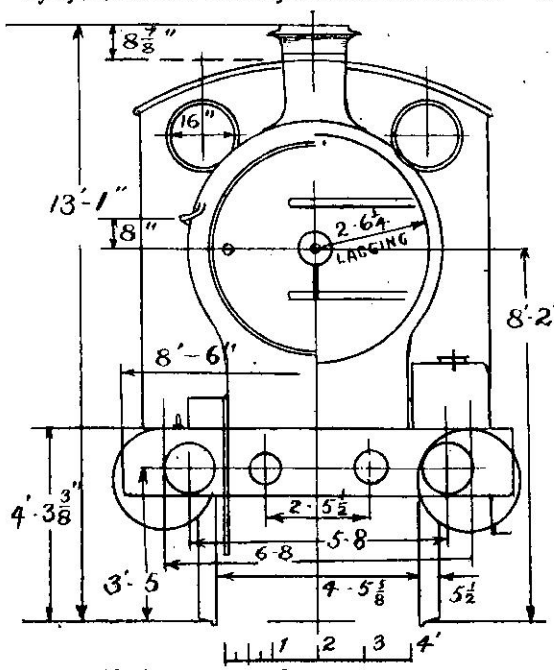
Locomotives Worth Modelling

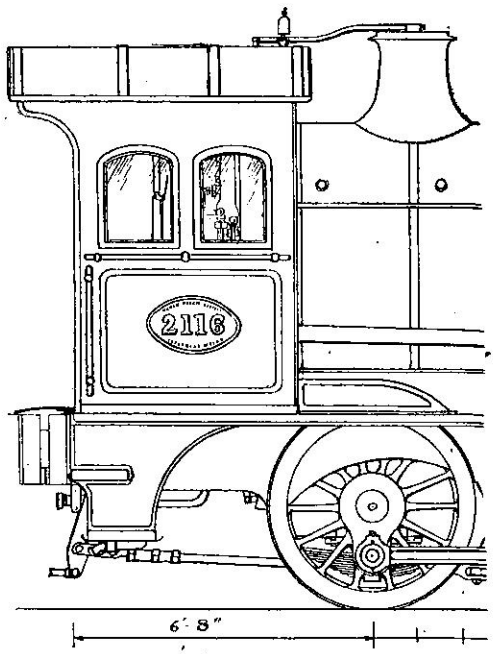
By F. C. HAMBLETON

No. 11—North Eastern Railway No. 2116

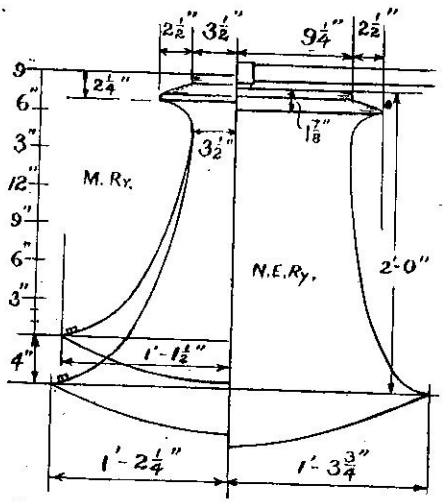
AS a contrast to the medium-powered goods engines which I have been recently describing, what about a glance at a regular whopper? You know, the kind of chap that walks off with a mere 1,300 tons without a murmur! There is a fascination in the very small locomotive, of course, but there is also a glamour surrounding the giant. In this connection how well we remember the growth of the coupling-rod in our earlier days! From the modest 7 ft. 7 in. of Stroudley's *Gladstone*, to the 9-ft. rod of Johnson (which he first introduced on his 4-4-0, M.Ry., No. 2183, in 1892) we felt to be a tremendous step. And when Dugald Drummond had the temerity to give us a ten-footer on his splendid L.S.W. No. 702, we almost expected to see this monster buckle-up into all sorts of fantastic curves as soon as the wheels went round! But nothing so spectacular happened, and we soon got used to the sight of those shapely polished rods gently revolving, as one of the nicest-looking of locomotives sped its way to sunny Bournemouth. I remember reading once in an engineering treatise that the ideal connecting-rod was of infinite length. I thought immediately of Webb's *Hardwicke*, with a 7½-in. rod urging round a 12-in. crank, and swallowed hard! Yet, *Hardwicke* was a flyer, if ever there was one, and some fine and fast angular antics must have been going on during her record run from Crewe to Carlisle on that memorable August 22nd, 1895.

Or again, think of Stroudley's *Gladstone*. A 78-in. connecting-rod associated with a 13-in. crank-ratio, 1 to 6, and almost the same as *Hardwicke's*. Soon after this startling gap between theory and practice, another wonder crossed my path—this time one of those *lovely* official photographs of a Worsdell N.E. Ry. engine. Now a volume, at least, could be written about official photographs, and a jolly interesting book, I believe, it would prove to be. But surely, oh! surely, there never was a more attractive series to delight the eye of the locomotive enthusiast than those pictures of N.E.R. engines. Of course, there were two good reasons for this. Firstly, the puffers themselves were particularly handsome, and secondly, the gent who took them was a peculiarly gifted artist—one of those clever chaps with just the right touch. He made each new type look more attractive than its predecessor! How marvellous that epoch-making 4-6-0 No. 2001 appeared to be! No wonder they wanted to send one of her sisters to the Paris Exhibition of 1900—just to show 'em what Gateshead really could do in the locomotive line. One had hardly got over the excitement of all this when a most

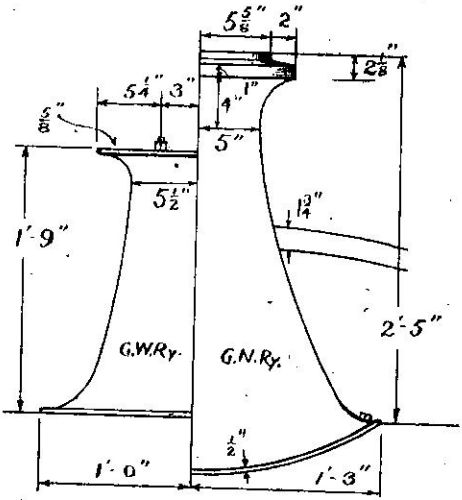




Moving forward with irresistible might!

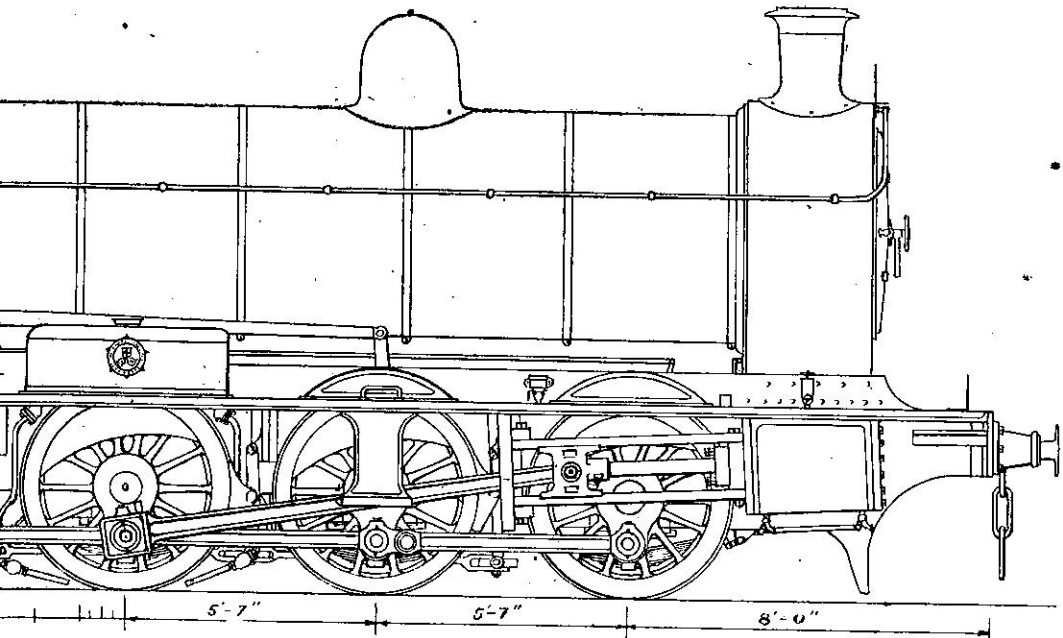


Comparative profiles of M.Ry. and N.E.R. polished brass valve-covers



Let's complete the set by including the Pat Stirlings, and one of Dean's many—and handsome—covers!

delightful thing happened! The by now familiar N.E.R. outlines transformed themselves into a super 0-8-0 goods engine. Even today, as I examine the sectional drawings of this beauty, I thrill to the sight of her 4-in. diameter piston-rod, her colossal 15-ft. boiler, and (here comes the cream of the matter) her grand 10-ft. connecting-rod. Ah! now at last we were approaching a bit nearer to the theoretically perfect relationship betwixt rod and crank—120 to 13 in., that is to say, almost as 1 is to 9. And a nice looking connecting-rod it was. Wilson Worsdell was a designer of the first order, everything of his was so beautifully proportioned. That giant connecting-rod looked simply grand, as it slowly revolved with its irresistible might, an impressive effect heightened by the background of the accompanying three



Shift 1,300 tons? Of course I can—easily!

lengths of coupling-rods. The fascination of speed appeals undoubtedly to all railway lovers. But what about the attraction of a locomotive moving along very slowly? Who has not, at some time or another, actually walked at the side of an engine which was barely moving down a shunting road? Or, maybe, along a departure platform as the "ten-o'clock," receiving the final "right-away" from the guard, made its first thrilling movement forward towards its far-distant destination? Just the same with our miniatures. That is why I am sure No. 2116 would make a grand model. One could watch that tremendous 10-ft. connecting-rod slowly turning round and round at one's leisure. And just picture the effect of the giant boiler!

One could see the whole of its lovely cylindrical form from end to end, so high pitched was it. The eye was led on towards the cab, a real North Eastern, with curiously low side windows and deeply curved roof. The boiler mountings, too, were first class.

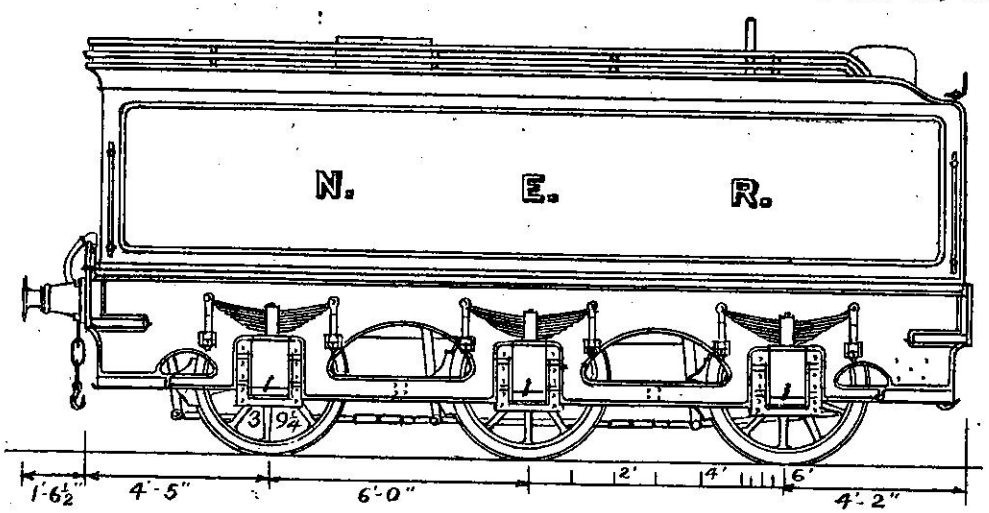
Picture the tall polished brass valve-cover, as seen in perspective, against the nice brass-rimmed circular windows, the jolly dome, and that masterpiece of a chimney with its gleaming brass cap placed high up on a smokebox noteworthy for its satisfying proportions. Study the position of the handrails, the pleasing splashers set against the long level of the top of the main frames, and the brass number-plate with its black background. All these items fell just into their right places, each contributing almost unconsciously, one might be led to say, to a most lovely engine. Clean, sweet and strong. stood No. 2116, on her eight grand wheels.

Here again was the same sense of fitness of design, the big crescent balance weights revolving round finely shaped hubs, the deep-section coupling-rods and magnificent 10-ft. fluted connecting-rod keeping gravely in time with all the harmonious revolving masses. Surely never a finer-looking engine, so characteristic of all that was best in English locomotive design at that period, was ever built up North! One, I suppose, is tempted to dwell on exterior appearances. Especially is this true of the model maker, the amateur who is really not so concerned with performance as is the professional engineer, whose job it is to get the modern heavy loads shifted along the line from place to place. It is doubly pleasing, therefore, to recollect what wonderful feats these engines performed, and be it remembered, all this taking place before the introduction of superheating, forced lubrication and the like. During a test between Stella Gill and Tyne Dock one of these monsters climbed a ¾-mile bank of 1 in 108, containing two sharp curves, with a load of 81 trucks and a van, the total weight of which was 1,326½ tons. Good show! as we should exclaim these days, and as we look at our model the recollection of such meritorious performances does endear the little miniature more and more to us. Yet the old saying "A true mother loves all her children" also may find remembrance in our minds.

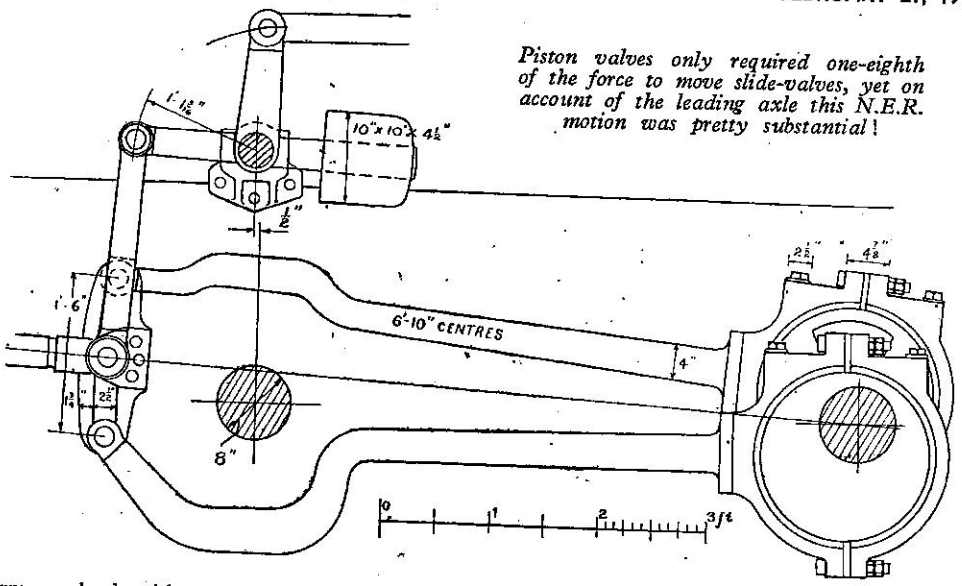
And that sets us a-thinking, Why do we really model locomotives? Is it performance, beauty, or personal acquaintance that urges us forward on our delightful task? Most of my friends firmly allege that, in the long run, it is the two latter qualities that most strongly influence them. What sentimental creaures, luckily, we are! An old hard-bitten driver, leaning out over the side of the cab of an ancient and decrepit puffer once remarked to me, "Yes, sir, an awful old crock—but some'ow I loves *all* ingines!!"

Yes, he was right, for unconsciously he had voiced the feelings of every true locomotive modeller. We do love *all* "ingines."

The N.E.R. engines were light green, edged with black, a fine inner white line separating the two colours. Angle frames black, lined with a fine red line. Guard-irons also black. The buffer-beam and buffer-sockets were red, the



A tender, lovely alike in photograph or model. Note the unusual location of the tool-boxes—across the tank



Piston valves only required one-eighth of the force to move slide-valves, yet on account of the leading axle this N.E.R. motion was pretty substantial!

former edged with a black and white line. Cab roof white, interior of cab grained, and the gilt tender letters were shaded with red. The boiler bands were black with a fine white line on either side—the whole scheme achieving a magnificent effect.

Useful Dimensions

Cylinders, 20 in. by 26 in.; piston-valves, 8¾ in.; ports, 1 ft. 7¾ in. by 1⅛ in.; maximum travel of valves, 4 21/32 in.; lead, ⅛ in.; length of slide-block, 1 ft. 5 in.; diameter of wheels, 4 ft. 7¼ in.; crank pin, 5 in. diameter by 6⅜ in.; frames, 1 in. thick, 4 ft. apart; boiler, diameter outside, 4 ft. 9 in., boiler length, 15 ft. 0 in.; firebox, length, 7 ft. 6 in.; weight, (W.O.) 58 tons 6 cwt.; tender frames, ⅞ in.; tender distance between, 6 ft. 2¾ in.; tank, 3,164 gallons; coal, 5 tons; weight, (W.O.), 38 tons 12 cwt.

The Harrow Exhibition—(*Continued from page* 193)

The Miniature Section, presided over by Mr. Perrin, put up some track stands and rolling stock, and made a good show for those interested in "OO" gauge.

Our thanks are due to the Kodak Society of Experimental Engineers and Craftsmen, for the loan of exhibits from that society, prominent among which were the excellently made boats of the Kodak trainees under the supervision of Mr. King.

Also, our thanks are due to the Watford Society for the loan of models, the most impressive being Mr. Thornton's G.W.R. 5-in. 4-6-0, 4-cylinder "King," which should develop into a tremendously powerful engine.

An outdoor track, kindly loaned by the Watford Society, provided further attraction. Numerous rides were given to the youngsters by Mr. A. D. Pole's 37-year old 5-in. "Tilbury," but it is to be regretted that rain somewhat spoiled the performance. The Watford track is a soundly constructed, multi-gauge track, 100 ft. in length, designed by their chairman, Mr. Snelling, and is capable of taking the heaviest of loads.

A small air-compressor proved exceedingly useful in running various models; also on this stand was Mr. Pole's new L.N.E.R. 1-in. scale "A5" 4-6-2T locomotive, supported upside down, running under air, affording an unusual view of a locomotive.

During the evening, Mr. Westbury created a diversion, by running his 6-c.c. petrol engine, fitted with his own design "Atomag" magneto. This engine, running at 10,000 r.p.m., sounded like a swarm of angry bees.

The catering was provided by Mr. L. Launer, and excellently served by a few of the members' wives.

The judging, which is no easy task at any exhibition, was carried out—and, we hope, to everyone's satisfaction—by Mr. E. T. Westbury, of THE MODEL ENGINEER, Mr. Snelling, chairman of the Watford Society, and Mr. Thornton, a Watford member, to all of whom our thanks are due.

Sound effects and light music were provided by Mr. Fox, the "mike" proving exceedingly useful for commanding attention and making announcements.

We must give Mr. Emery due praise for the work he put in to make the show the success it undoubtedly was. We hope that our next event will take place not so late in the year.

There was a steady stream of visitors from 2 o'clock until 9.30 p.m.

Roundabout Engines

By P. W. BRADLEY

THE steam machinery used by the travelling showman is full of interest, and although the big road locomotives naturally claim the most attention, the engines used for driving the various riding machines are also a joy to any steam fan.

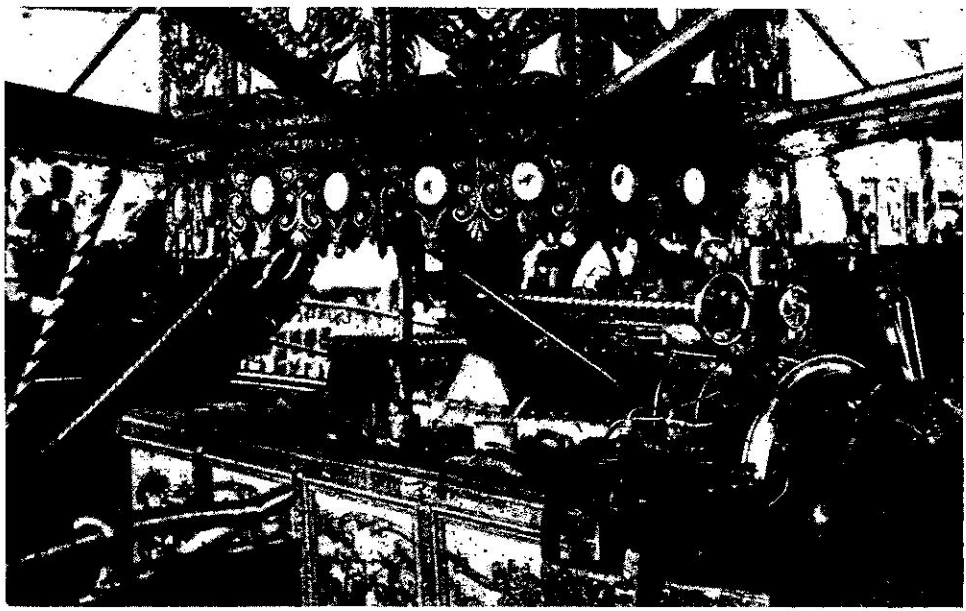
The famous firm of Savage's, of King's Lynn, were always in the forefront as builders of steam roundabouts, etc. Centre-engines built by them in the 'nineties can still be seen at some fairs; while the latest of their productions of this kind that I can trace is a set of "Steam Yachts," delivered new, as recently as 1928. The majority of the steam-centres still in use were constructed by this firm, although examples of Walker (Tewkesbury), and Tidman (Norwich), engines are to be seen.

Circular Rides

Portable engines built for roundabouts proper, (*i.e.* circular rides), are invariably twin-cylinder "simples," having the motion-work fitted on top of the boiler, and the cylinder block at the firebox end. Nearly all have "in between" valves, although a few "Tidmans" have the valves outside the cylinders. In switchbacks, "platform horses," and other rides, in which a track takes most of the weight of the revolving structure and riders, the engine is mounted longitudinally on its truck, and the smokebox carries the fixed "centre pole," about which the revolving portion turns on roller-bearings. The firebox is therefore at the end of the truck, where it can conveniently be fired. The first illustration, which shows a good example of this type, shows a Savage engine in use in a "Venetian Gondolas" switchback. The drive is also apparent, a bevel pinion on the crankshaft driving a large bevel gear on a vertical shaft journalled in a footstep bearing on the truck floor. On this shaft, but hidden by the ornate carved and mirrored work is a pinion driving (internally) a bar-toothed gear ring on the revolving portion. The larger of the two hand-wheels shown operates a friction brake, and the smaller one the regulator. The organ of the roundabout is driven by a separate small single-cylinder vertical engine, (known as the "model" engine) mounted above the truck floor on a box pedestal to the right of the firebox. Part of this engine can be seen in the photograph, and it is, of course, supplied with steam from the main boiler. The truck itself is timber-built, with wooden wheels, and is raised on a gantry; the engine being kept as high as possible to ease the stress on the "pole" and smokebox.

"Galloping Horses"

The familiar "galloping horses" roundabout has rather different requirements, for the centre



A "Savage" twin-cylinder portable engine driving a "Venetian Gondolas" roundabout

has to support the whole weight of the top frame, horses, riders, and platform. This demands a very substantial centre structure, particularly in the large "four-abreast" sets, which carry 56 horses and seat 112 riders. In all known examples of "gallopers" (except traction-centre types, which I shall mention later), the centre pole is continued downwards through the centre-truck floor, and is packed and supported by an ingenious arrangement of struts, jack-beams, screw-jacks and packing, which enable the centre to be "set" firmly on any surface, from a muddy field to a steeply-cambered street. The engine in these roundabouts is, in the case of Savage, Walker, and most Tidman sets, mounted transversely on a dropped platform across the rear of the truck. The second picture shows a typical "Savage" of this type. The drive takes the form of spur reduction gearing (incorporating a clutch and friction brake) to a short countershaft. At the other end of this shaft is bevel gearing to a vertical shaft similar to that in the first photograph, and the inevitable internally-driven bar-tooth gear is also found. The second picture shows the feed-pump clearly (in some Tidman sets it was mounted vertically) and also shows the organ engine on its bracket above the smokebox. Sometimes, in the larger "four-abreast" types, this engine was fitted on the truck floor near the firebox and in such cases the smokebox carried an ornamental "chimney." This was really rather unfair on the fond parent whose son, perhaps an embryo steam engineer, insisted on knowing why no products of combustion issued from the highly-polished brass funnel! How was he, poor man, to know that in the massive timber underworks of the centre-truck, there was concealed a flue, running from the side of the smokebox base to the hollow centre-pole?

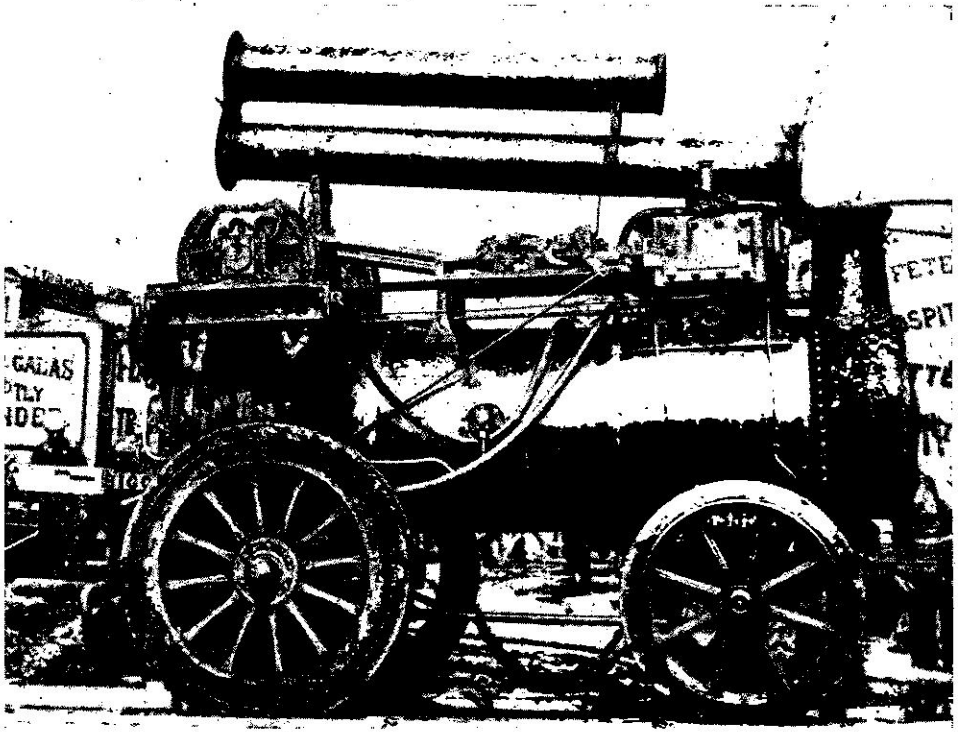
Some Tidman-built "gallopers" had the engine mounted longitudinally on the truck, not unlike the "switchback" arrangement already described, but the centre-pole was carried through the truck floor, and not mounted on the smokebox of the engine. A difficulty with this type lay in that despite jacks and cross-chains galore, the centre-truck had a tendency to rock on its wheels when the engine was running fast, and with a "suspended-platform" roundabout, this could cause endless trouble.

Remarkable Machines

These remarks on centre-engines would be incomplete without reference to a unique switchback which travelled the Border Country some years ago, and was driven by a compound engine taken from a Foden steam wagon. Also, a tribute must be paid to the firms of Burrell, Savage, McLaren, and Fowler, for their traction-centres. These remarkable machines, of which no example is known to remain in existence, comprised a road locomotive with a tower permanently erected over the motion-work, on top of which the turntable for the roundabout was mounted. The drive was by spur and bevel gearing from the crankshaft, and when in use for roundabout driving, the waste gases were led through a branch flue over the motion into the "centre-pole." Few particulars are available of these machines, but I do know that they were used in "gallopers," "dobbies," (*i.e.* non-galloping horses) and switchbacks; and the Savage examples were made in both single-cylinder and compound form.

The third photograph shows the Savage portable reciprocating engine as built for "Steam

"Savage" transverse-type centre-engine, as used for driving "Galloping Horses" roundabouts



"Savage" reciprocating engine for operating "Giant Steam Swings"

yachts." Considerable power was demanded, as the two boats each seated about forty riders, and for obvious reasons, it was required to attain the maximum swing as quickly as possible. An ingenious automatic tripper gear to the valves made the action automatic after starting. The tall chimney (shown folded) is always fitted to these machines, and not the least attractive feature to the steam fan is the sharp "chuff," which can always be heard above the shrieks of the riders. The example of a "yacht-engine" shown, is marred by the fitting of iron wheels to the front axle, but the characteristic wooden-spoked wheels are retained at the rear.

Tunnel Railways

Then we have the fascinating "Tunnel railway." This once-popular ride comprised a circular narrow-gauge railway track, about fifty feet in diameter, about half of which was enclosed in a tunnel. The locomotive, usually built by Savages, was generally of 2-2-2 wheel arrangement, with fixed radial axles, and had steeply-inclined outside cylinders.

The Savage fair-ground type of portable engine also enjoyed popularity as a power unit for electric lights, when this "novelty" first appeared on fairgrounds. For this purpose, the engine was built with the cylinders at the smokebox end, but was otherwise very similar to the roundabout engines. Together with an open-type dynamo of the period, driven by belt from the flywheel, the engine was mounted on a timber-built wagon, which was horse-drawn. These "light engines," as they were termed, were also built by Messrs. Foster, of Lincoln, and enjoyed popularity about forty years ago, but when the showman-type road locomotive came into general use, they naturally passed out of favour.

If any enthusiast can offer more explicit particulars of the types and designs of this little-known branch of steam engineering, I am sure many readers, myself certainly included, would be most grateful.

CHANGE OF NAME

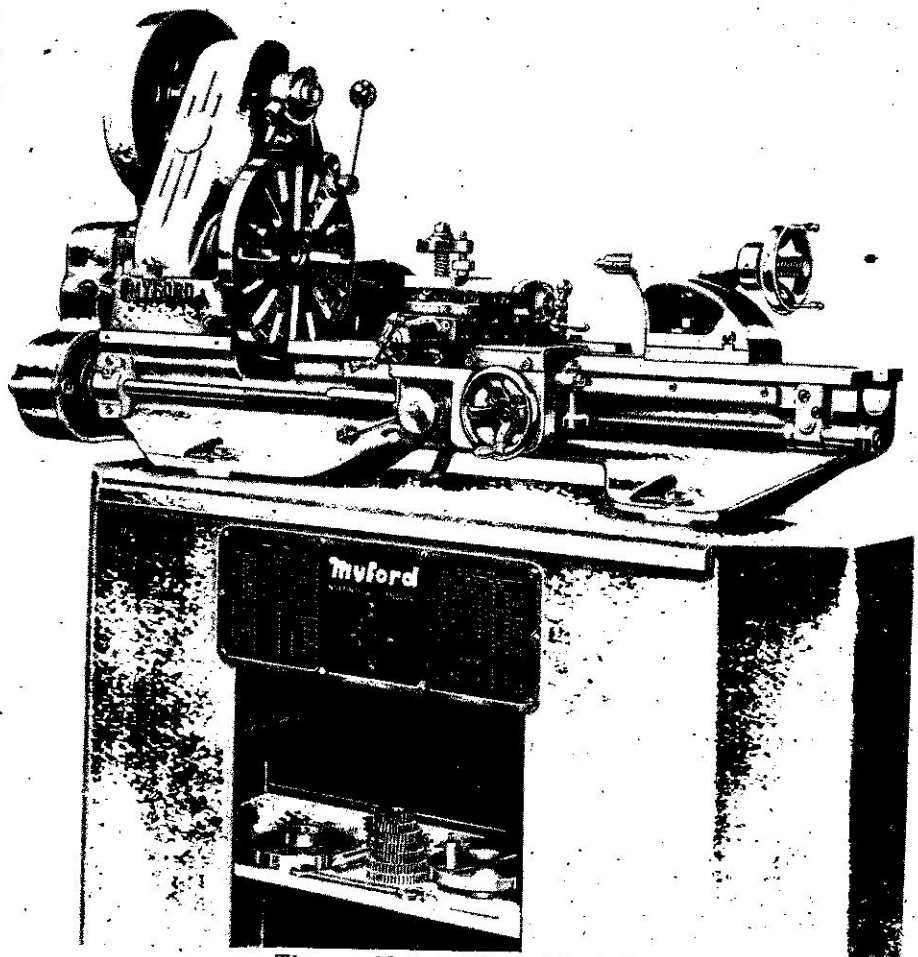
Southern Ignition Co. Ltd., 190, Thornton Road, Croydon, has changed its name to Max Electric Co. Ltd. The direction of the company and of the sister company, Max-Arc Welders Limited, remains in the hands of Mr. P. S. Jackson, M.I.E.E., M.I.E.(Ind.), M.I.W., who served for many years in India, with Cromptons, English Electric and G.E.C. The company dropped ignition work some years ago, and the management feels that the new name will be more suitable, in view of the firm's activities as electric motor and electrical appliances manufacturers and repairers.

A New Myford Lathe

MANY improvements have taken place in the design of all types of machine tools, as a result of the exacting demands of war production. In the case of lathes, many new special-purpose types have been developed, to enable particular forms of work to be handled more expeditiously, and the more orthodox general-purpose machines have been improved in rigidity, in the capacity to deal with increased power input, to take advantage of new cutting steels, and the range of feeds and speeds has been increased. But even in lathes of the light type, not intended for intensive quantity production, the experience gained during the war has led to many detail improvements in design, also in methods of construction and standards of accuracy in manufacture. As a result, not only the professional engineer, but also the amateur, may count on reaping the benefit of these developments, and post-war machine tools will enable both classes of users to produce better work, more expeditiously, and with less risk of error.

Several makers of lathes, of a type in which the readers of this journal are primarily interested, have been busy developing new designs for the post-war market, and some of the results have now begun to appear. We have lately been given some preliminary information regarding a very interesting new production by the Myford Engineering Company, Beeston, Notts., whose works equipment and production capacity have been enormously improved during the war.

The company's premises now cover an area of 45,000 sq. ft., and the plant, which is continually being increased, is highly specialised and



The new Myford M.L.7 3½-in. lathe

includes the latest types of surface, cylindrical and slideway grinding machines.

In giving readers a provisional description of this lathe, which is known as the Myford M.L.7, we should like to make it quite clear that the lathe is not yet in full quantity production, and that until an announcement is made by the company that it is ready for the open market, enquiries made by prospective buyers will only be embarassing to both parties. The specification of the lathe, as described below, may possibly be subject to slight detail modification, before production arrangements are finally settled.

The general outline of the lathe is pleasing, and we think readers will agree that the much-criticised tendency of British manufacturers to disregard the appearance of a utility product, has been corrected in this case. There has,

View from headstock end, showing gear enclosure, and primary and secondary belt guards

however, been no attempt to copy popular practice in either British or foreign lathe design, but the guiding principle has been to produce a lathe which is versatile, accurate, durable, and capable of heavy duty, but moderate in cost withal. Several distinctive and praiseworthy features of British lathe practice are apparent in the design, notably the gap bed, large-size boring table, and hollow tailstock barrel. All these features are important from the model engineer's point of view, as they improve the adaptability of the lathe, and its capacity to handle special jobs, including boring, milling, and many operations outside the range of orthodox lathe work.

Attention is directed to the fact that special facility is provided for electric drive, "motorisation" being a built-in feature. No separate driving units are required, and mounting, either on bench or stand, involves only the bolting of the lathe down to a true level surface, positioning the starting switch, and connecting up to the mains.

The bed of the M.L.7 lathe is of the flat-top, square-shear type, with narrow guide surfaces and deep girder beams. Overall length is 3 ft. 0½ in., the maximum length admitted between centres being 1 ft. 8 in. Total width across shears is 4½ in., of which the front shear takes up 1⅜ in., and the rear shear 1⅜ in.; the depth of shears at the flat edge is ½ in. Depth of bed, from top-surface to feet, is 5⅜ in., and width across feet, 5⅝. Maximum swing over bed is 7 in. diameter, swing in gap 10 in. diameter, and width of gap, in front of standard faceplate, 1½ in. All slideway surfaces of bed are precision ground.

Headstock

This is of completely new design, and embodies the feature of an underhead back-gear shaft, which not only renders the assembly more compact, facilitates enclosure, and improves appearance, but also gives a wider choice of driving angle than is usual. Both the smaller gears, or pinions, of the gearing are of phosphor bronze, that attached to the headstock pulley having an extended sleeve which forms the bearing for the pulley when it is running free on the mandrel. By offsetting the spindle towards the rear of the machine, rigidity when turning work of large diameter is improved, the effect being equivalent of using a bed 5 in. wide. The seating of the headstock is 7⅝ in. long by 4⅜ in. wide.

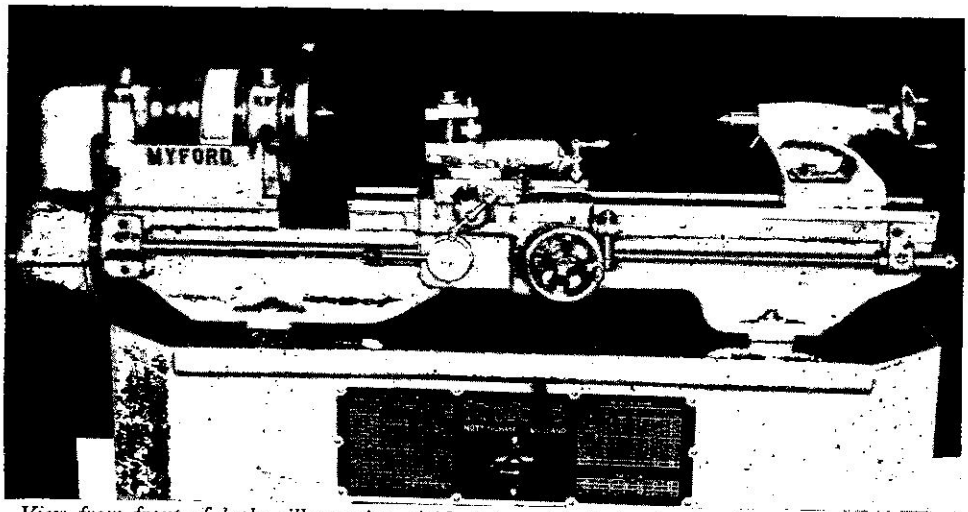
The main spindle, of high-tensile steel, runs in bearings of Glacier T1 anti-friction alloy, of the half-step type, provided with laminated shim adjustment.

Front bearing is 1¼ in. diameter, by 2 in. long, rear bearing 1 in. diameter by 1⅜ in. long, a ball thrust-race 1 in. diameter being provided in front of the rear bearing. Levers for operating the tumbler reverse gear and back-gear eccentric shaft are located at the left and right of the headstock respectively.

The spindle nose is screwed 1⅛ in. by 12 t.p.i., and has a parallel register 1¼ in. diameter by 7/16 in. long. It is bored to take No. 2 Morse centres, and has a bore of 19/32 in. continued right through the mandrel. The standard faceplate is 6¾ in. diameter, with eight slots, but the 9 in. faceplate shown fitted to the lathe in the photographs is available as an extra fitting. A three-step pulley for ½ in. "A" section vee-belt is provided, giving standard speed ranges of 640, 348, and 192 r.p.m. on direct drive, or 107, 58, and 32 r.p.m., with the standard back-gear of 5.96 to 1 reduction ratio. Provision may also be made for a speed range of 740 to 37, or 884 to 46 r.p.m.

Saddle

This is of the narrow guide type, with extended front and rear horns at the tailstock end to provide maximum length of guide, and equipped with a positive locking clamp for use when surfacing.



View from front of lathe, illustrating rigid design of bed, headstock and tailstock. (Motor and driving gear removed)

A gib is provided for adjustment against the front shear of the bed, and the underside retaining strips at front and rear have laminated shims for adjustment. The area of saddle bearing surface is 19 sq. in., and self-sealing spring-ball oilers are provided for the lubrication of saddle surfaces and traversing mechanism. A felt wiper pad is fitted to the edge of the saddle on the headstock side to protect the surfaces from swarf and grit.

A rack-and-pinion hand traverse gear is provided, with a 3½-in. handwheel, one rotation of which moves the saddle through a distance of 0.86 in., and an intermediate gear is included in the drive so that normal direction of saddle traverse is produced, in relation to handwheel rotation. The split clasp nut of the leadscrew is positively opened and closed by a cam and lever, in a similar manner to that which has proved highly successful in earlier lathes. Provision is made for the fitting of a screwcutting indicator on the right-hand side of the apron. The maximum diameter of work which will swing over the cross-slide is 4⅛ in.

The top surface of the cross-slide forms a flat, rectangular boring table with an area of 30 sq. ins., having four ⅜-in. tee-slots for holding work, or other fixtures. An extended feed-screw bearing increases the traverse of the cross-slide, which is 5 in., or sufficient to face the full radius of the largest work which will swing in the gap, without resetting the tool. Both the cross-slide and top-slide have feed screws of 10 t.p.i., Acme form, with renewable nuts, and are provided with micrometer dials 1½ in. diameter, having 100 divisions, thus giving increments of 1/1000 in. of slide movement.

Top-Slide

A circular base, graduated in degrees, is provided for angular adjustment, and is clamped down by bolts at front and rear. Maximum swivelling range is 63 degrees on each side of the zero position. The maximum travel of the top slide is 2½ in. The standard form of openside tool clamp, as used on earlier models, is retained, in an improved form, incorporating the use of a spherical seated thrust washer, to avoid side thrust and binding on the stud; a four-way turret tool-post can be supplied as additional equipment. Removal of the top-slide unit leaves the cross-slide boring table absolutely clear.

Tailstock

The base is guided by a tongue between the shears, having a gib for adjustment. Set-over adjustment of the back-centre is provided, positively guided by a cross tongue to maintain parallel alignment of the barrel, and set screws front and rear facilitate adjustment and locking of this movement. The tailstock assembly is locked to the bed by a quick-action lever clamp, and the barrel is provided with a locking lever nut at the rear. Range of set-over adjustment is $\frac{7}{16}$ in. towards the front, and $\frac{3}{16}$ in. towards the rear. The tailstock barrel is bored right through 19/32 in. diameter with a No. 2 Morse taper socket for centres.

The leadscrew is of 8 t.p.i. pitch, Acme form, and is extended at the tailstock end, to allow of the fitting of a graduated handwheel for fine traversing of the saddle, if desired. It runs in bearing brackets provided with self-lubricating "Oilite" bushes (these are also used for the apron gearing and back-gear shafts), and spring-ball oilers are fitted. A change-wheel guard, completely enclosing the gears, but readily removable, protects the latter, and also the tumbler reverse gear, which is fitted as standard. A range of 14 change-wheels to cut practically all British and metric standard threads is supplied, the range being from 6 to 112 t.p.i., or 0.25 mm. to 4 mm. pitch. The finest feed obtainable with the standard gears and fittings is 0.0037 in. per revolution, or approximately equivalent to 270 turns per inch.

Motorising Gear

This is built on to the back of the lathe bed, at

the rear of the headstock, and comprises a bracket carrying a countershaft in swinging bearings, operated by a cam and lever to facilitate speed changing. The motor base is slotted, and pivotally mounted on the bottom of the bracket, with a slotted bar for primary belt adjustment. Secondary belt adjustment is provided by means of screw-operated pads bearing on the cams of the tension gear. "Oilite" bearings are fitted to the countershaft, and the pulleys are balanced.

The guard over the secondary belt slides upwards and backwards, on guides, to permit easy access to the belt for speed changing. Motors for d.c. supply up to 250 volts, single-phase a.c. up to 250 volts, and three-phase a.c. up to 500 volts, can be fitted as standard, the power being 1/3 h.p. in each case, and speed 1,420 r.p.m. (for 50-cycle supply). Resilient-mounted motors are fitted or recommended in all cases.

A new departure in lathe stand design is the provision of a fabricated sheet-steel cabinet stand of octagonal form, having the top surface, middle and bottom shelves welded to the body, and angle stiffeners provided internally to take the weight of the lathe, also similar stiffeners at the bottom, with extended feet drilled to take ⅜ in. holding-down bolts. The exposed edges of the body and shelves are double-turned to increase rigidity and avoid sharp edges. A panel at the front of the cabinet provides a location for the motor-reversing switch, and also carries a process-engraved chart for screw-cutting pitches and feeds.

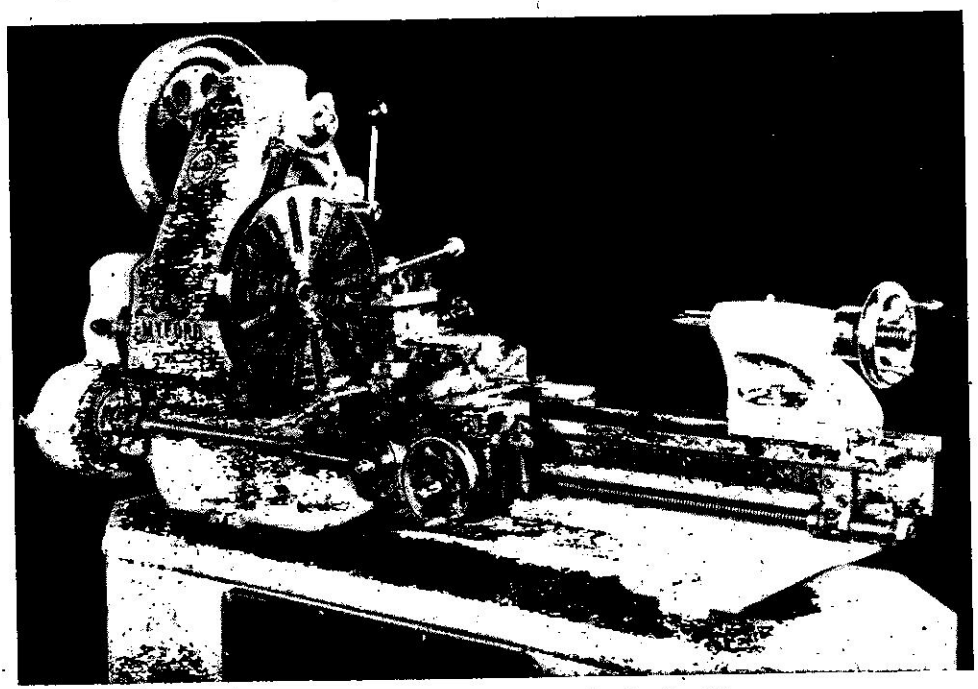
The standard equipment provided with the lathe includes the 6¾ in. diameter faceplate already mentioned, a catch-plate for centre turning, and a 4 in. diameter back-plate; a set of 14 change-wheels and spacer-bush, change-wheel guard, two double-ended spanners, and keys for back-gear lock and main bearing cap screws. On motor-driven machines, two belt guards, for primary and secondary belts, are provided.

Extra equipment includes a travelling steady which bolts on the left-hand side of the saddle, an extension to which is provided for the purpose. It is of the two-point type, and takes work of a maximum diameter of 2 in. The fixed steady is of the three-point type, with a hinged top, and has a capacity for work up to 2 in. diameter. Flat bronze bearing pads are used, reversible for large or small diameter work, and interchangeable for either the fixed or travelling steadies.

A taper turning attachment, in which the cross-slide is temporarily detached from its feed-screw, and controlled by means of an auxiliary slide at the rear of the bed, is available, and holes are drilled and tapped in the bed for the reception of the screws to hold this fixture, complete interchangeability being ensured by precision jigging.

Several special attachments for the lathe are also in course of preparation, including new vertical slides, both of the fixed and compound swivelling type, and a universal dividing

(*Continued on next page*)



Another view of lathe, showing details of saddle

Small Cine Projector Design

By H. J. H.

MANY years ago, I experimented extensively with standard kinematograph apparatus. In more recent times, I handled sub-standard apparatus, and with it I never had the same results as with the former, due, I believe, to the varying conditions under which it was used and the fact that I did not experiment with it for best results under fixed conditions. Steadiness was satisfactory but, at times, there was flicker, and I came to the conclusion that it proved my earlier contention that a particular shutter may only suit a particular intensity of screen illumination. The variations introduced were: distance from screen with a fixed source of illumination; thin pictures and dense pictures. To understand what I mean, one has only to run a projector with and without a film in the gate and note the amount of flicker on the screen. If possible, continue the test at different distances from the screen and alter the intensity of illumination; also the type of screen.

Whether a shutter is before or behind a lens does not matter one iota; but if it is behind the gate, its use as a cooling fan may be warranted. The obturating-blade should cover the picture shift, and it is a matter for experiment as to whether this actually covers the whole movement or something slightly less. With a projector, one tries to get as much light on the screen as possible, whereas, with a camera, the opening of the shutter is adjusted to suit the speed of the object being photographed (not usually so with an amateur camera). The opening of a camera shutter may only be a fraction of that on a projector. In either case, it must cover the film during period of movement of the film past the gate aperture. If it is out of phase, in a projector, travel-ghost will appear.

The angle of the obturating-blade is governed by the relation of shift-period to still-period per frame and the number of revolutions made by the shutter-spindle per frame. It may not be desirable for the flicker-blade on a projector to be "solid" or opaque; it may be translucent or coloured, or even perforated. If I remember correctly, many examples of variants are shown in R. B. Foster's *Living Pictures*. Similarly, the obturating-blade may be modified to pass a certain amount of light provided that it effectively hides the picture shift. From the foregoing, it should be clear that it is not sufficient to provide a number of alternations to overcome persistence of vision with a view to reducing flicker.

Of the projectors I handled, there was nothing to beat a Powers Cameragraph for steadiness, and I think this was largely due to its long gate. Circumstances alter cases. The pressure applied must be even and just sufficient to arrest the momentum of the film due to action of intermittent motion, and also to prevent film creep or buckling, due to its being continuously fed from the top sprocket.

Another point in projector design is that the picture should be projected on the screen as long as possible. Which means the period of shift should be very much shorter in duration than that of actual still projection; thus, the intermittent mechanism must be designed to this end. The relationship is usually about one to five; if the difference is much greater, there is rather heavy load on the film perforations, since, all other things being equal, the same amount of work must be done in less time, when shifting the film intermittently through the gate. For some reason, claw movements have found their way into sub-standard projectors; they are satisfactory with perfect film perforations in camera and projector, but if the perforations are imperfect there is trouble. With perfect perforations, a claw mechanism will give a constant shift and, for that reason, is generally used in cameras. As worn or torn film is passed through a projector, matters are rather different and it is not known why an intermittently operated sprocket is not used to any extent with sub-standard projectors. It has the advantage that the load or force required for shifting the film is applied over a number of perforations, thus distributing the wear which occurs at one or two perforations only in the case of a claw mechanism. An ideal for an intermittent motion is that there shall be no snatch at the perforations; the movement of the film should be similar to the movement of a piston of a steam engine in this respect. All parts of the projector need to be well balanced to reduce vibration.

In conclusion, I may say that shutters alone are not the only cause of flicker. I have known a bad belt fastener on a belt-driven generator cause it by making the light unsteady in itself, or by the flicker of the light synchronising with a period of the shutter and so producing a "beat" effect similar to a radio heterodyne. An axially-oscillating shutter spindle may be a contributory cause, especially if the gear happens to be loose on the shaft.

A New Myford Lathe

(*Continued from previous page*)

attachment, suitable for gearcutting and other similar operations. We hope to be able to publish descriptions of these in due course.

The M.L.7 lathe will supplement the existing productions of the Myford Engineering Company, including the popular "M" type, (formerly Drummond) 3½-in. lathe, which is already well known to model engineers, and the M.L.2 (3⅜-in.) and M.L.4 (3½-in.) lathes, the design of which have been brought fully up to date, and methods of production improved.

Clubs

South London Model Engineering Society

The next meeting will be held on Sunday, March 3rd, at Kings College Sports Ground, Dog Kennel Hill, East Dulwich, at 11 a.m., Mr. Davidson will give a talk on "Milling."

The mid-week meeting for February 27th is "Surprise Night," and starts at 7.30 p.m. A hearty invitation is extended to visitors or prospective members.

Several track runs have been arranged already and a very interesting series of talks for the coming weeks, full particulars of which can be obtained from :—Hon. Secretary : N. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Bath and District Society of Model and Experimental Engineers

The first annual general meeting will be held on February 22nd, at the Club Rooms, 23, High Street. Members should make every endeavour to attend, for it is only by knowing your views and opinions that the Club's future can be planned to the greatest benefit of all.

Because of the calls of business, our secretary, to whom the Club owes much for its success, has reluctantly declined to seek re-election to office in the coming year.

Visitors and prospective members are welcome to join us any Monday or Friday evening at the club rooms.

Hon. General Secretary : J. R. H. CADE, 25, Upper Borough Walls, Bath.

Leeds Model Railway and Engineering Society

A meeting will be held on February 24th, at Mr. F. Cook's, Kidacre Street, when the tools, models, etc., belonging to the late Mr. Clifford Benson will be disposed of, afterwards, work on track additions will be continued.

Hon. Secretary : J. W. SEYMOUR, 12, Outwood Walk, Horsforth.

Glasgow Society of Model Engineers

A special meeting will be held within the Society Rooms, on Saturday, February 23rd, 1946, at 7.30 p.m., when A. J. Brown, president, will repeat his paper recently given before the Ayr S.M. & E.E. The subject dealt with is "Ship Design," while some very fine drawings kindly loaned for the purpose should make the meeting attractive to those whose interests are marine in tendency.

Secretary : JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

Andover and District Model Engineering Society

The Society is making good progress. The first exhibition will be held at the Guildhall, Andover, on Easter Saturday and Easter Monday, It is hoped to have a passenger-carrying track in operation. Among the many exhibits will be two models of early type locomotives, a Stirling single and a Johnson single.

Hon. Sec. : W. H. CROTHALL, 35, Charlton Road, Andover.

Kodak Society of Experimental Engineers and Craftsmen

On January 12th, a most interesting meeting was held in the Supervisors' dining room, when Mr. Westbury gave a talk on "Model Internal Combustion Engines." Anyone who has heard of Mr. Westbury, or has read his articles in THE MODEL ENGINEER, will know that he is a master of his subject.

Numerous lantern slides were shown illustrating engines of various types, some designed and built by the lecturer, others representing examples of the work of various notabilities of the model world.

A very hearty vote of thanks was accorded to Mr. Westbury at the conclusion of his talk. Replying briefly to this, Mr. Westbury then handed round some "bits and pieces," including a very compact lightweight fly-wheel magnet of high efficiency. This was incorporated in a miniature two-stroke engine which was shortly afterwards demonstrated. Things then began to hum, or perhaps scream would be the better word, for the engine put up a terrific speed, driving an air-screw of about 10 in. diameter.

Further interest was created by a demonstration run of one of the new compression-ignition type models. This also put up an excellent performance, and a hearty round of applause followed. The enthusiasts then swarmed round Mr. Westbury to ply him with questions and to examine the models. I think we can truthfully say that "A good time was had by all."

Welling and District Model and Experimental Engineering Society

An alteration has been made in the date for the Social, to March 16th, at Welling Co-operative Hall, near Welling Corner. Tickets will be strictly limited, due to smallness of hall.

February 23rd will be a Locomotive night, open to visitors.

Hon. Secretary : E. D. DIXON, 262, Sutherland Avenue, Welling, Kent.

Chesterfield and District Model Engineers Club

Meetings of the above Club have been arranged for the following dates, at William Rhodes Secondary School, Chesterfield, 7.30 p.m.

Tuesdays, March 5th and 26th ; April 9th and 30th ; May 14th, and June 4th and 18th. In addition to the above, visits to local works are being arranged, and members will be advised of the dates when they are definitely fixed. New members are always welcome to these meetings, and should contact the Hon. Secretary : R. C. G. COSTIGAN, 175, Somersall Lane, Walton, Chesterfield.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Maidenhead, Berks.

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Private: **Threepence** *word.* *Trade*: **Sixpence** *word.* *Use of Box* **2/6** *extra.* *Minimum charge,* **3/-**

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For Consistent Quality, friendly service and prompt deliveries—GARNERS, Sheffield Road, Barnsley. 'Phone 2866.

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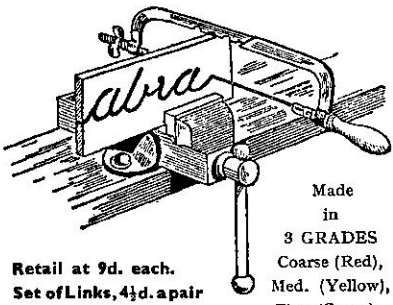

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